

# Enhanced Delta Smelt Monitoring

## Preliminary Abundance Analysis

### Phase 3 Sampling

**DRAFT**

U.S. Fish and Wildlife Service

August 4, 2017

## Overview

Beginning July 2017, the Enhanced Delta Smelt Monitoring (EDSM) program started its Phase 3 sampling program. The Bay-Delta has been divided into eight geographic strata:

- Western Delta
- Suisun Bay Marsh (Suisun Bay and Marsh)
- Lower Sacramento
- Cache Slough LI (Cache Slough and Liberty Island)
- Sac DW Ship Channel (Sacramento Deep Water Shipping Channel)
- Upper Sacramento
- Lower San Joaquin
- Southern Delta

Sampling locations are generated using a generalized random-tessellation stratified (GRTS) design [1] with stratification and equal probability sampling. Trawling gear similar to that used in the California Department of Fish and Wildlife's [Spring Kodiak Trawl Survey](#) is used to conduct multiple tows per location.

Everything presented here is preliminary and subject to correction, revision, and improvement. The following points should be taken into consideration when interpreting the results:

1. Delta smelt caught in the wings of the net (as opposed to the live box or cod end) were excluded from this analysis. Fish caught in the wings are indicated by a Gear Condition Code of 9.
2. The **Week** designations used here were defined out of convenience and are subject to change.
3. Current sampling is limited to areas of the Bay-Delta with a depth of at least 8 feet at mean tide. The abundance estimation method used here assumes that the density of fish in unsampled areas (i.e., those with depth less than 8 feet) is the same as in sampled areas (i.e., those with depth greater than or equal to 8 feet).
4. The methods of analysis used here remain in development.

## Change Log

Report date July 10, 2017:

- No changes.

Report date July 14, 2017:

- Sample volume corrections were made for tows in Suisun Bay Marsh during Week 1. This resulted in an increase in the abundance estimate for that week.

Report date July 21, 2017:

- Total sample volume has been added to Table 1. Sample volumes are subject to correction.
- In some strata, a single tow was conducted at one of the sites in contrast to the standard two tow minimum. This change in procedure necessitates changes to the statistical model. While these changes are in development, simple stratified ratio-expanded estimates will be shown in Table 1.

Report date July 28, 2017:

- No changes since last report.

Report date August 4, 2017:

- Sampling in the Southern Delta has been temporarily suspended as catches are expected to be low based on historic data and conditions are expected to be inhospitable. During this time, the number of sampling sites in other strata may increase as resources allow.

## Results

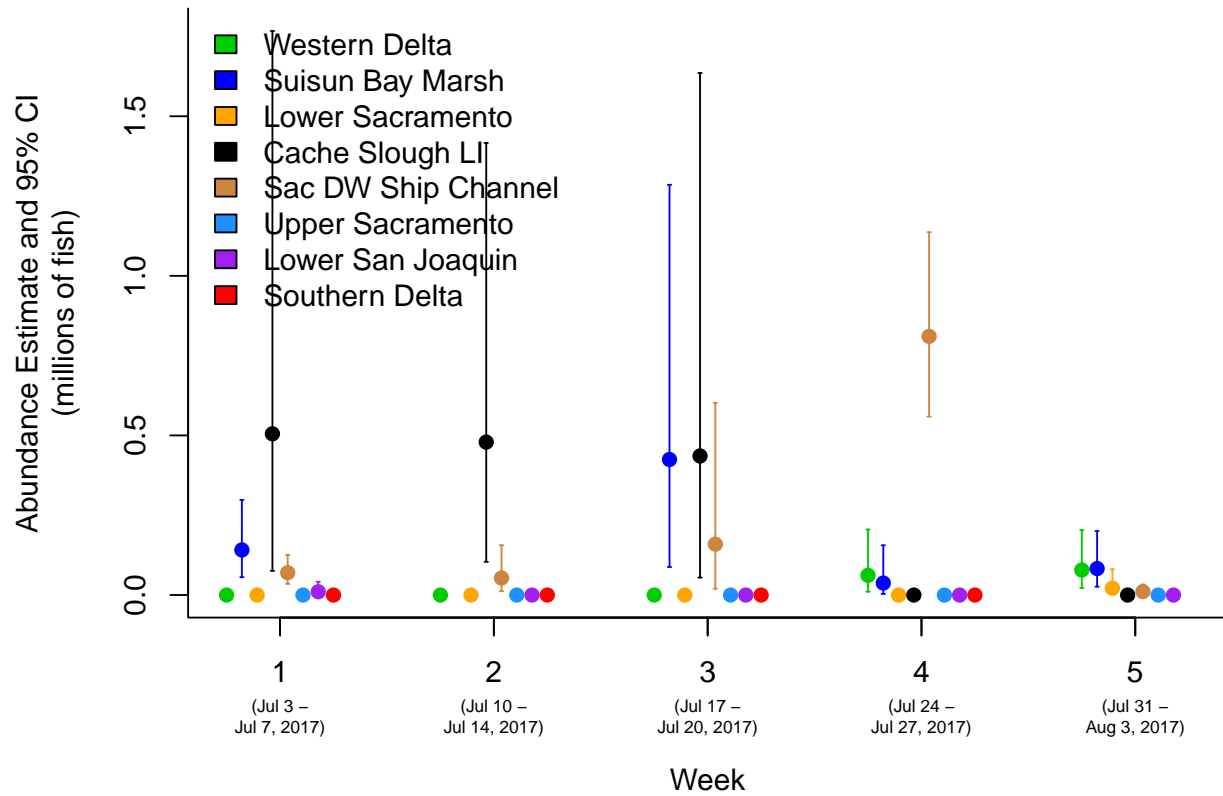
Table 1: Delta smelt catch summary and abundance estimates by week. An asterisk (\*) is used to emphasize weeks when no delta smelt were caught and a dash (-) is used to indicate that sampling did not occur or that a quantity could not be calculated. In order to avoid confusion, weekly totals are currently only calculated when sampling has occurred in every stratum. Sample volumes are in cubic meters. Values in blue use a stratified ratio-expanded estimation method that does not account for EDSM's stopping rules.

	Stratum	Number of Sites	Number of Tows	Number Caught	Total Sample Volume	Estimate and 95% CI		
						Abundance	Lower Bound	Upper Bound
Week 1: July 3 - July 7, 2017								
	Western Delta	4	32	0	130,560	0*	-	-
	Suisun Bay Marsh	2	5	5	12,373	141,293	55,832	297,925
	Lower Sacramento	2	10	0	21,249	0*	-	-
	Cache Slough LI	2	3	37	6,047	505,151	75,706	1,766,992
	Sac DW Ship Channel	2	4	9	4,462	70,077	35,057	125,938
	Upper Sacramento	2	13	0	44,296	0*	-	-
	Lower San Joaquin	4	20	1	32,098	10,376	1,107	41,414
	Southern Delta	6	48	0	179,539	0*	-	-
	Total	24	135	52	430,624	726,897	183,533	1,989,343
Week 2: July 10 - July 14, 2017								
	Western Delta	2	12	0	62,818	0*	-	-
	Suisun Bay Marsh	0	-	-	-	-	-	-
	Lower Sacramento	2	10	0	20,226	0*	-	-
	Cache Slough LI	2	7	25	10,323	479,200	104,033	1,416,325
	Sac DW Ship Channel	2	7	7	10,194	53,507	11,959	155,885
	Upper Sacramento	2	16	0	57,880	0*	-	-
	Lower San Joaquin	4	20	0	37,240	0*	-	-
	Southern Delta	6	48	0	191,973	0*	-	-
	Total	20	120	32	390,654	-	-	-
Week 3: July 17 - July 20, 2017								
	Western Delta	4	32	0	120,388	0*	-	-
	Suisun Bay Marsh	2	7	10	13,558	424,672	87,828	1,285,210
	Lower Sacramento	2	10	0	15,534	0*	-	-
	Cache Slough LI	2	4	27	5,117	435,653	54,781	1,635,421
	Sac DW Ship Channel	2	6	40	8,721	159,427	19,743	602,025
	Upper Sacramento	2	16	0	53,937	0*	-	-
	Lower San Joaquin	4	20	0	40,021	0*	-	-
	Southern Delta	6	48	0	199,987	0*	-	-
	Total	24	143	77	457,263	1,019,752	307,430	2,532,564
Week 4: July 24 - July 27, 2017								
	Western Delta	4	26	2	116,912	61,789	10,442	205,263
	Suisun Bay Marsh	2	10	2	18,635	37,562	3,594	155,752
	Lower Sacramento	2	11	0	23,195	0*	-	-
	Cache Slough LI	2	10	0	18,250	0*	-	-
	Sac DW Ship Channel	2	2	62	2,660	810,345	558,999	1,136,809
	Upper Sacramento	2	16	0	62,159	0*	-	-
	Lower San Joaquin	4	20	0	49,625	0*	-	-

Table 1: Delta smelt catch summary and abundance estimates by week. An asterisk (\*) is used to emphasize weeks when no delta smelt were caught and a dash (-) is used to indicate that sampling did not occur or that a quantity could not be calculated. In order to avoid confusion, weekly totals are currently only calculated when sampling has occurred in every stratum. Sample volumes are in cubic meters. Values in blue use a stratified ratio-expanded estimation method that does not account for EDSM's stopping rules.

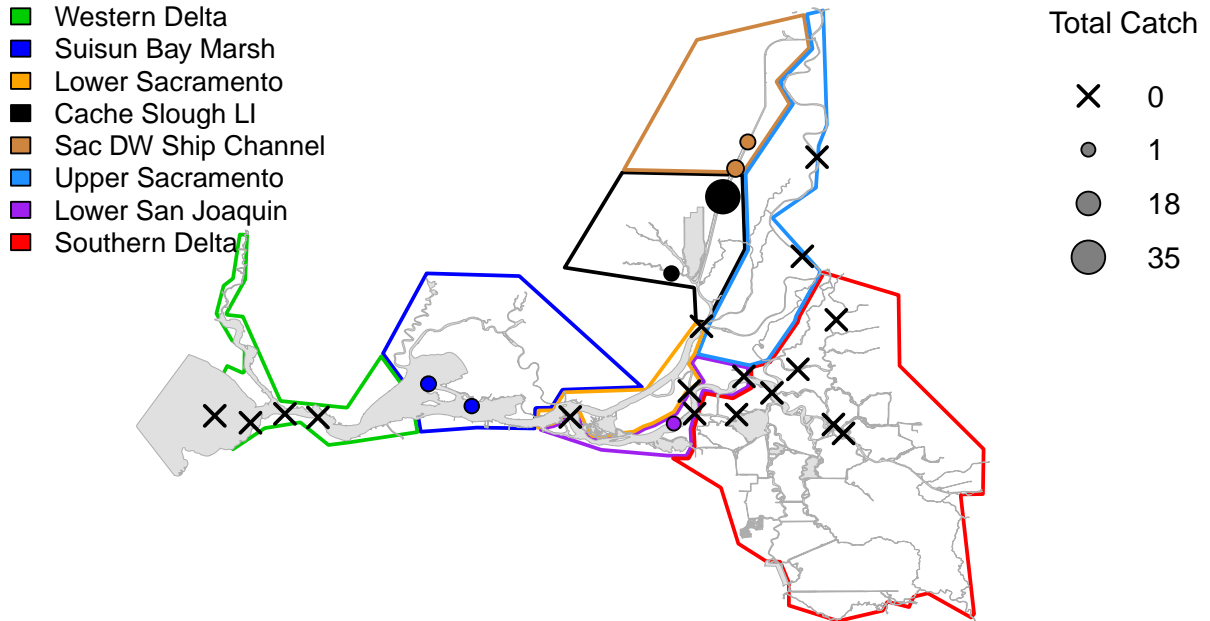
Stratum	Number of Sites	Number of Tows	Number Caught	Total Sample Volume	Estimate and 95% CI		
					Abundance	Lower Bound	Upper Bound
Southern Delta	6	49	0	201,306	0*	-	-
Total	24	144	66	492,741	909,696	630,017	1,272,003
<b>Week 5: July 31 - August 3, 2017</b>							
Western Delta	8	52	8	265,007	78,466	21,851	203,714
Suisun Bay Marsh	5	15	4	29,564	82,966	26,248	200,410
Lower Sacramento	2	7	1	12,931	21,336	2,632	80,685
Cache Slough LI	2	10	0	15,046	0*	-	-
Sac DW Ship Channel	2	7	2	13,950	10,727	2,149	32,965
Upper Sacramento	2	16	0	52,469	0*	-	-
Lower San Joaquin	4	20	0	34,067	0*	-	-
Southern Delta	0	-	-	-	-	-	-
Total	25	127	15	423,034	-	-	-

### Delta Smelt Abundance Estimates Over Time

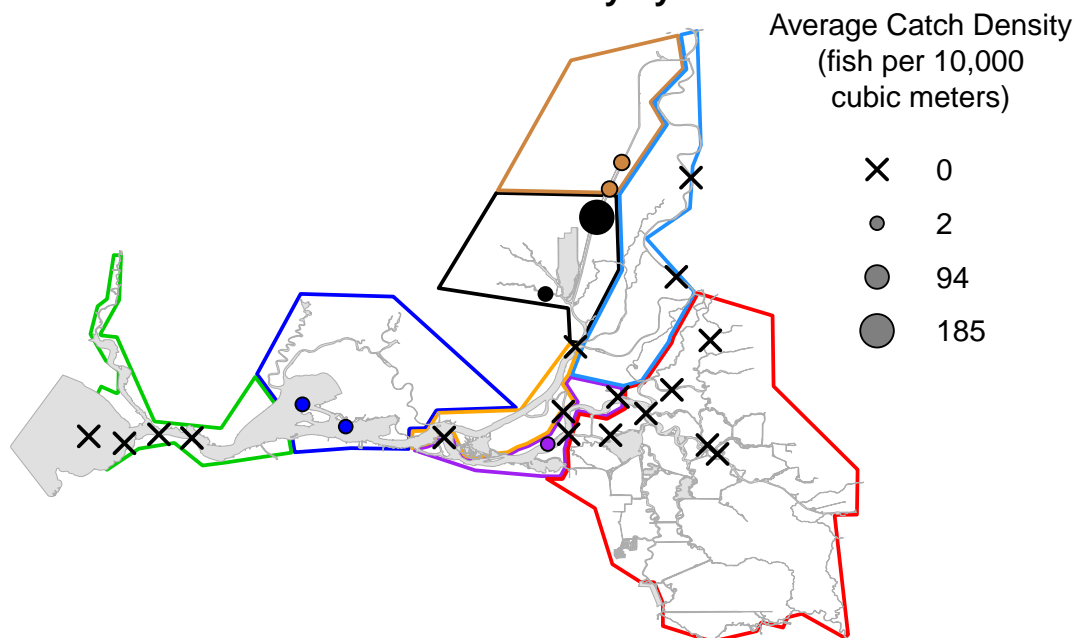


## Week 1 (Jul 3 – Jul 7, 2017)

### Delta Smelt Total Catch by Site

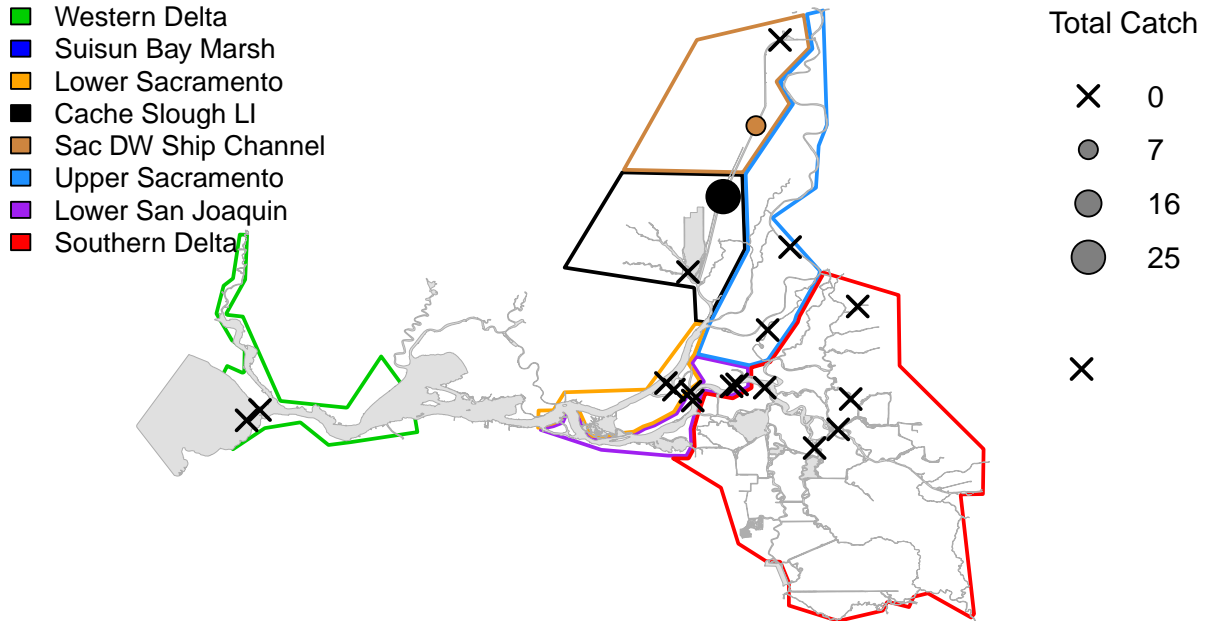


### Delta Smelt Catch Density by Site

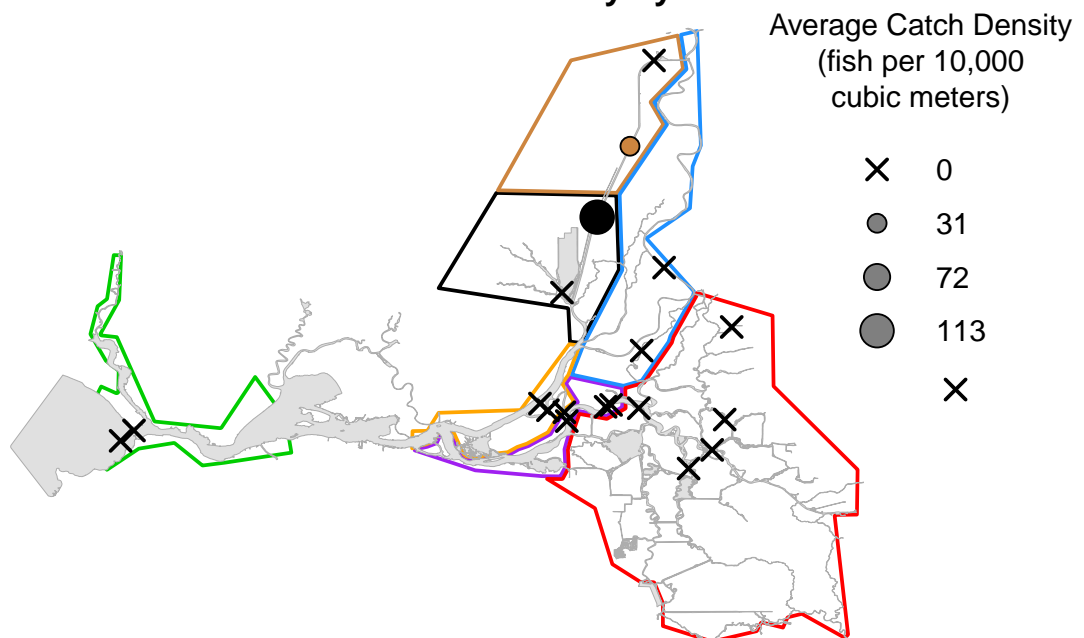


## Week 2 (Jul 10 – Jul 14, 2017)

### Delta Smelt Total Catch by Site

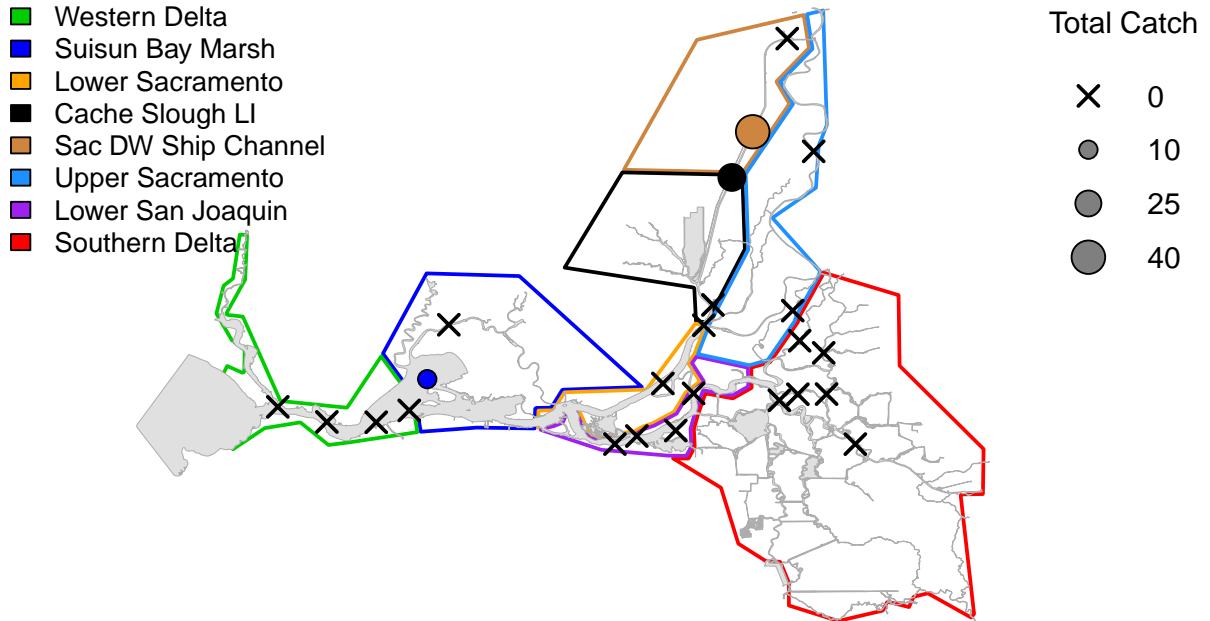


### Delta Smelt Catch Density by Site

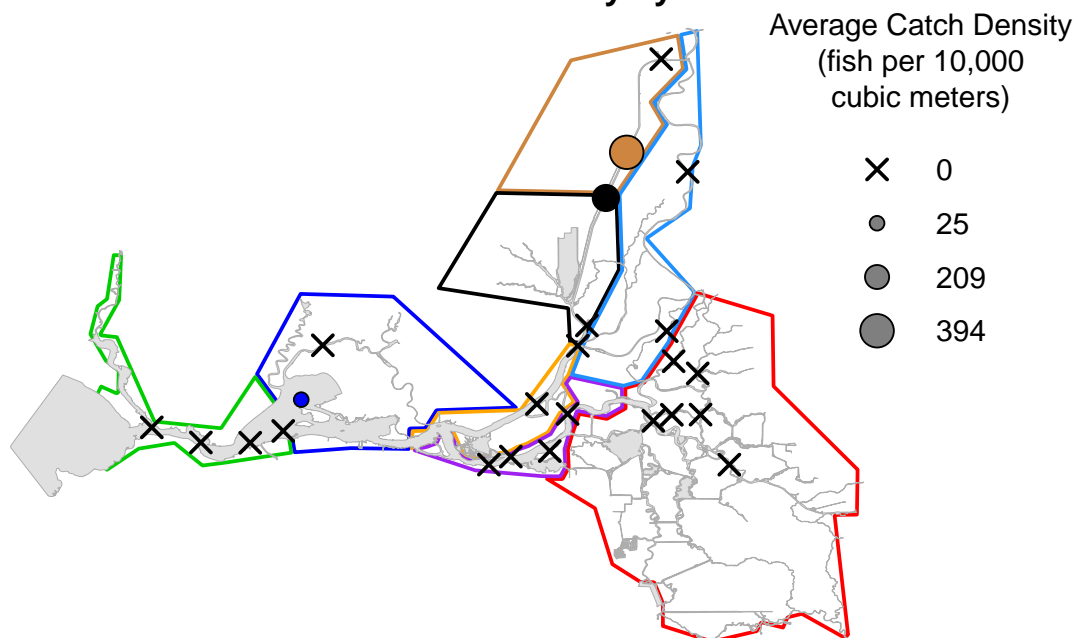


## Week 3 (Jul 17 – Jul 20, 2017)

### Delta Smelt Total Catch by Site

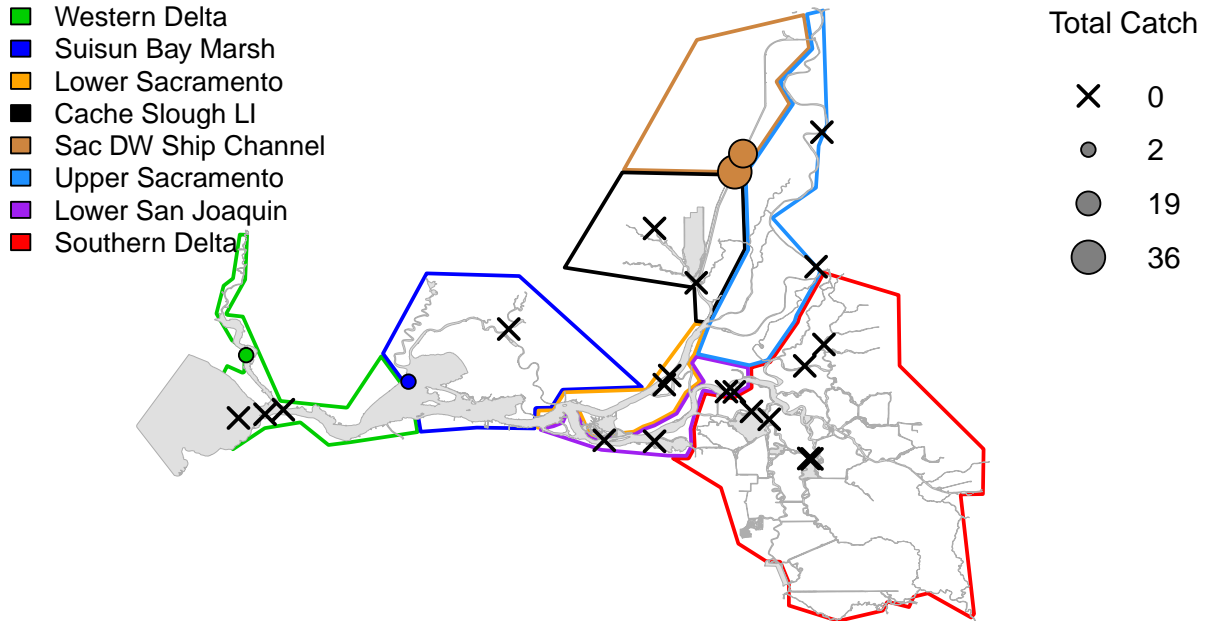


### Delta Smelt Catch Density by Site

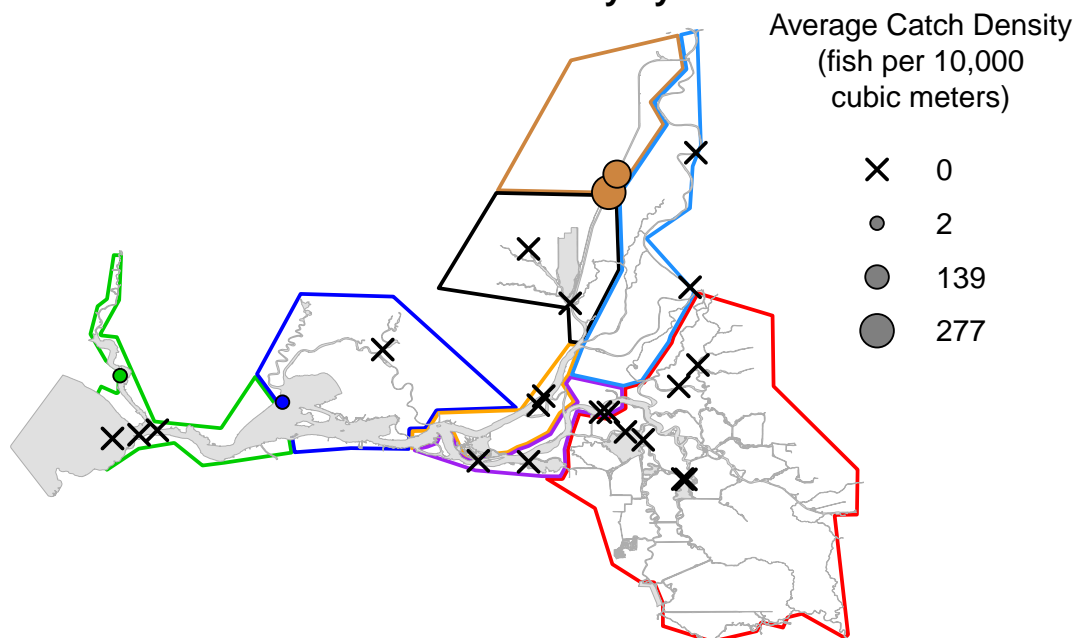


## Week 4 (Jul 24 – Jul 27, 2017)

### Delta Smelt Total Catch by Site

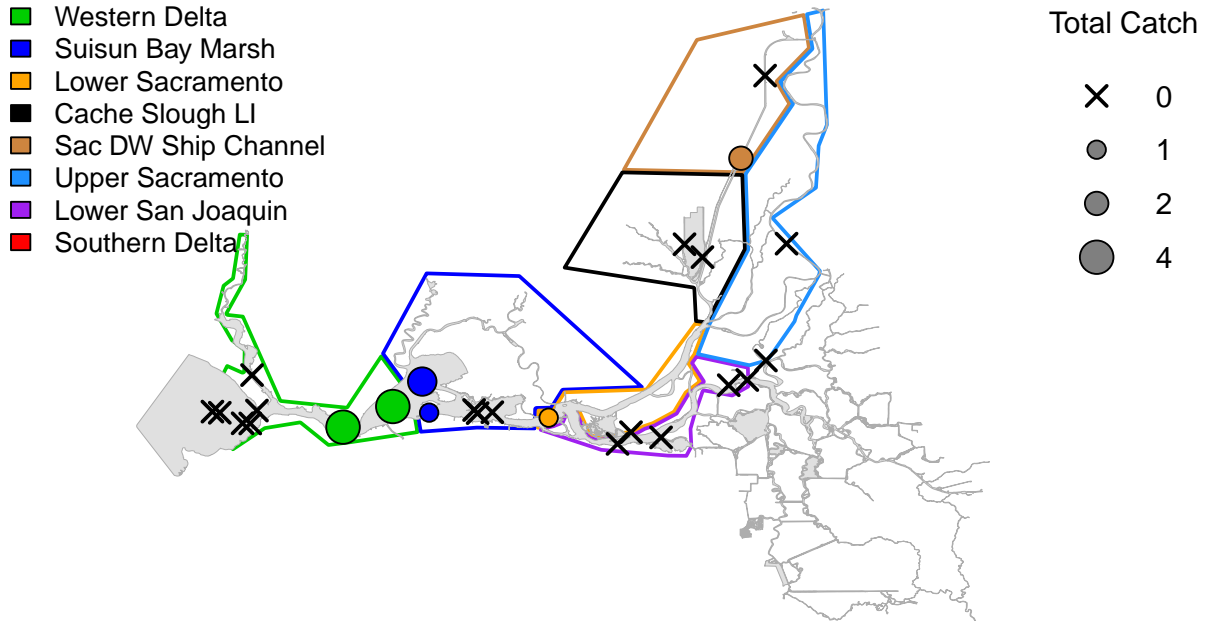


### Delta Smelt Catch Density by Site

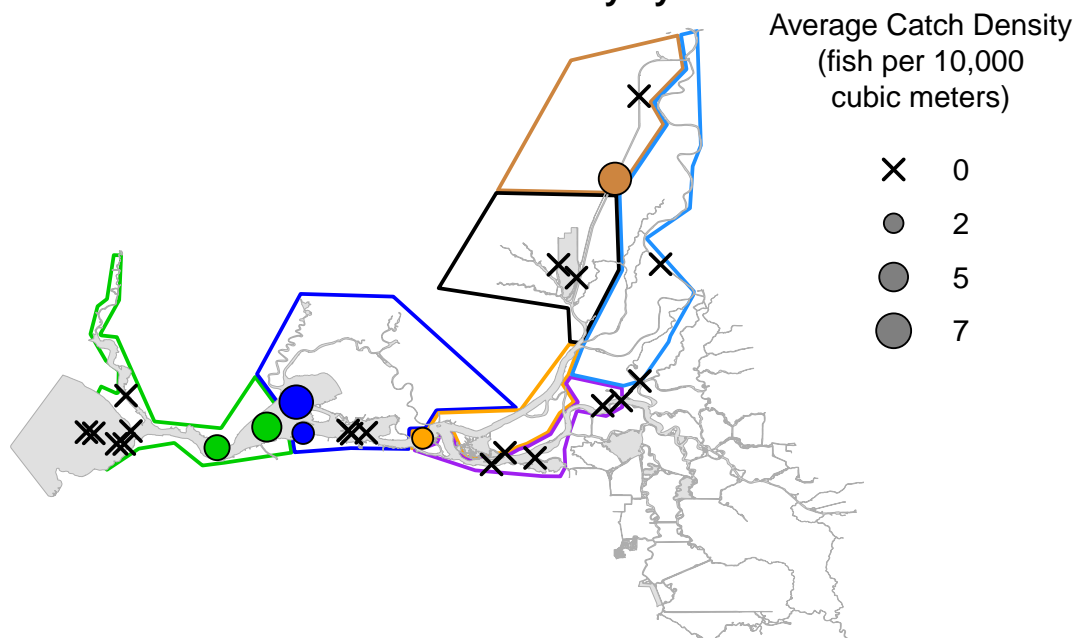


## Week 5 (Jul 31 – Aug 3, 2017)

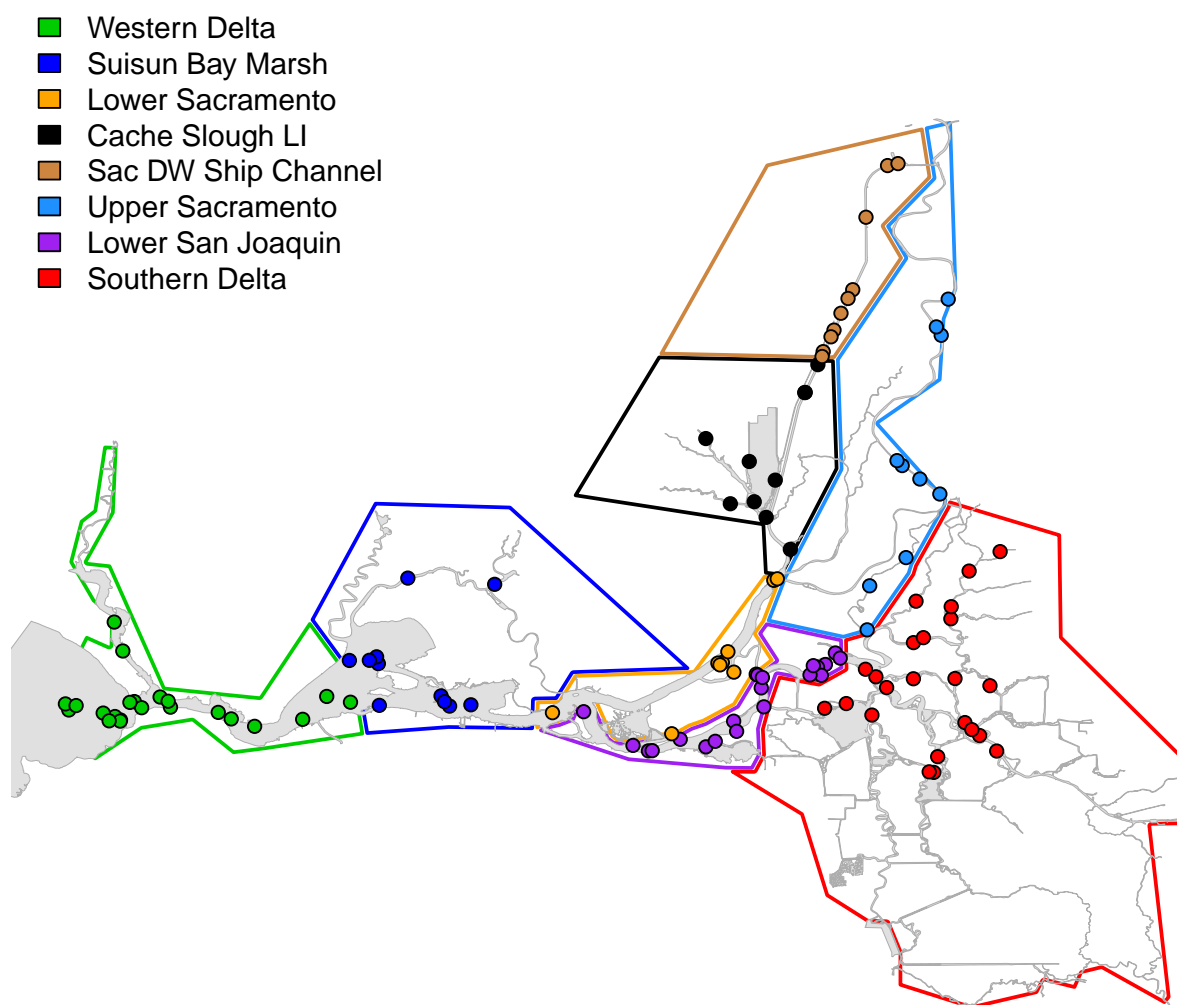
### Delta Smelt Total Catch by Site



### Delta Smelt Catch Density by Site



## All Sampling Locations To Date



## References

- [1] Stevens, Don L., Olsen, Anthony R. 2004. Spatially balanced sampling of natural resources, *Journal of the American Statistical Association*, 99(465): 262 – 278.